

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
LightSquared Technical Working Group Report)	IB Docket No. 11-109
)	
LightSquared License Modification Application, IBFS Files Nos. SAT-MOD-20120928-00160, -00161, SES-MOD-20121001-00872)	IB Docket No. 12-340
)	
New LightSquared License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091)	IB Docket No. 11-109; IB Docket No. 12-340
)	
Ligado Amendment to License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091)	IB Docket No. 11-109
)	

PETITION FOR RECONSIDERATION

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EXECUTIVE SUMMARY

Iridium Communications Inc. (“Iridium”), Flyht Aerospace Solutions Ltd., Aireon LLC, and Skytrac Systems Ltd. seek reconsideration of the Federal Communications Commission’s (“FCC’s” or “Commission’s”) Order and Authorization in this matter (“*Order*”). The Commission repeatedly accepted Ligado’s claims at face value despite overwhelming evidence that Ligado’s operations will cause harmful interference with a wide range of civilian and military operations. The *Order* violates core requirements of the Administrative Procedure Act (“APA”), entirely ignoring material evidence and arguments that spoke directly to the inquiry before it and offering explanations that ran counter to the record. The Commission should reconsider the *Order* and deny Ligado’s requests.

The Commission erroneously dismissed the public interest harms associated with a grant of Ligado’s modification request. Iridium and others submitted reams of evidence, argument, and technical analysis showing that Ligado’s operations would cause harmful interference, undermining billions of dollars of investment and jeopardizing national security. The *Order* sidestepped these concerns, insisting that there would likely be no such interference and that any harmful interference would be remedied by the “conditions” the Commission imposed on Ligado. These premises were badly mistaken. The record included abundant studies and analyses proving that Ligado’s operations *would* produce harmful interference – material the *Order* dismissed on the flimsiest of grounds. The Commission inexplicably applied 2005 out-of-band emissions limits despite evidence that the assumptions supporting such limits no longer apply. It offers no technical analysis of its own in support of this choice, nor can it point to any material supplied by Ligado itself. Whereas Iridium did submit such analysis, the *Order* rejects that evidence, largely on the basis that Iridium assumed the power levels that Ligado had proposed, rather than the level selected by the Commission – even though the Commission easily could have modified the results and seen that the study showed harmful interference at that level, too. The *Order* likewise dismissed the interference concerns raised by the executive branch – specifically, the Department of Defense (“DOD”), the Department of Transportation (“DOT”), and the Department of Commerce’s National Telecommunications and Information Administration (“NTIA”), each of which is assigned statutory responsibility with respect to the interference concerns at play here.

The *Order* ultimately acknowledges that some harmful interference is likely, establishing purported mitigation mechanisms. These measures violate Section 343 of the Communications Act, which demands not that the Commission urge parties to discuss interference but that the Commission *resolve* interference. They also contravene Section 25.255 of the Commission’s rules, which requires the ATC provider to remedy any harmful interference. In any event, the “remedies” the *Order* imposes simply will not work. The agreements Ligado has made with several GPS providers do not provide any cause to believe that Ligado can or would reach similar agreements with others, particularly after receiving FCC approval. Likewise, the suggestion that imposition of a new power limitation in the band adjacent to Iridium will address Iridium’s concerns is a non-sequitur, because, while an improvement, even the new power limit will not cure the harmful interference at issue. The *Order*’s proposed mitigation measures with respect to military users fares no better – the *Order* requires *consultation* but does not mandate any *action* by Ligado if it does not agree that it will produce harmful interference. Even if it did, Ligado is barred by law from providing funds to DOD for the replacement of equipment.

The *Order* barely addresses the alleged public interest benefits of Ligado’s offering. Its anemic discussion merely regurgitates Ligado’s talking points – including its incorrect contention that its service will promote 5G – without even addressing record critiques of those claims or balancing the purported benefits of Ligado’s hypothetical offering against its attendant harms. Even so, the best the Commission can do is to conclude that the proposed service “could” become a useful offering.

Finally, the Commission committed error in waiving the “integrated service” rule. For starters, it should have acted via rulemaking, as it has before in similar matters. It further failed to satisfy the basic criteria for waiver by showing that waiver better served the public interest than application of the rule or articulating the special circumstances warranting waiver. Indeed, it could not have done so, because waiver here will prolong or exacerbate Ligado’s failure to invest meaningfully in the MSS marketplace. The conditions applied to the 2011 waiver did not prompt Ligado to deploy meaningful satellite service then, and there is no reason to believe they will now. The instant waiver will further undermine the public interest by eviscerating the long-standing protections that have allowed satellite services in the L-band to thrive.

For these reasons, the Commission should reconsider the *Order*, denying Ligado’s requests.

REDACTED – FOR PUBLIC INSPECTION
PETITION FOR RECONSIDERATION

Pursuant to Section 1.106 of the Federal Communications Commission’s rules, the undersigned parties seek reconsideration of the Commission’s April 22 Order and Authorization (“*Order*”) in the above-captioned matter.

INTRODUCTION

After nearly a decade of game-playing and plan-changing by Ligado Networks LLC (“Ligado”) and its predecessors,¹ and notwithstanding repeated demonstrations from Iridium Communications Inc. (“Iridium”) and others that Ligado’s evolving proposals would give rise to harmful interference, the Commission issued a deeply flawed, superficial decision that fails to satisfy the most basic substantive and procedural requirements governing agency action.

By all appearances, the *Order* reflects highly irregular decision-making in which the Commission allowed its desired outcome to dictate the analysis. The Commission’s response to Iridium’s concerns about interference is just one example. To “protect” Iridium from harmful interference, the Commission adopts a 15-year-old power limit premised on a deployment scenario bearing no resemblance to the scenario detailed in the record today. Meanwhile, it brushes aside robust technical analyses submitted by Iridium and others on the thinnest of bases. In one case, it faults Iridium for assuming that Ligado would be operating at the power levels set out in *Ligado’s most recent proposal* rather than divining that the Commission would approve a different power level. This is just a sampling of the many instances in which the *Order* ignores or shunts aside record evidence. In contrast, the *Order* repeatedly accepts Ligado’s claims at face value without providing any reasoned basis for rejecting critics’ concerns.

¹ As used in this petition, “Ligado” includes all predecessors-in-interest.

REDACTED – FOR PUBLIC INSPECTION

The Commission steamrolled not only inconvenient facts, but also Section 343 of the Act, which requires it (not others) to resolve harmful interference of the type relevant here, and Section 25.255 of its own rules, which puts the burden of resolving such interference on ATC providers themselves. Mentioning these authorities only in passing, the *Order* erroneously imposes conditions that improperly place the burdens of resolving interference caused by Ligado’s operations on parties suffering from the interference, such as Iridium. The Commission similarly waived its integrated service requirement without satisfying the “good cause” standard, and contrary to evidence that its waiver would undermine rather than advance that requirement’s objectives. Equally unlawful is the Commission’s curt dismissal of legitimate concerns raised by federal stakeholders exercising statutory and constitutional responsibilities to protect vital national interests, including national security concerns.²

DISCUSSION

The Administrative Procedure Act (“APA”) requires the Commission to undertake reasoned decision-making, and provides that conclusions not supported by such reasoning cannot stand.³ “[T]he agency must examine the relevant data and articulate a satisfactory explanation for its action including a ‘rational connection between the facts found and the choice made.’”⁴ Likewise, a decision is arbitrary and capricious if the agency “failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence

² Because this Petition does not involve a site-specific concern regarding interference, and because disputes over technical matters turn on the application and interpretation of evidence already in the record, the affidavit requirements of Section 1.106(e) do not apply here. 47 C.F.R. § 1.106(e). (calling for affidavit showing that “interference will be caused to *the station within its normally protected contour*”) (emphasis added). To the extent the Commission disagrees, Iridium respectfully asks that it waive any affidavit requirement in light of the nature of the dispute and the evidence already in the record.

³ *Fox v. Clinton*, 684 F.3d 67, 74-75 (D.C. Cir. 2012).

⁴ *Motor Vehicle Mfrs. Ass’n of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.”⁵ The *Order* failed to satisfy these basic legal demands.

I. THE COMMISSION ERRONEOUSLY DISMISSED THE PUBLIC INTEREST HARMS ASSOCIATED WITH A GRANT.

Iridium and others submitted abundant arguments, evidence, and technical analyses demonstrating that Ligado’s offering would cause substantial public harms that outweighed its purported benefits. Among other things, Iridium provided multiple analyses demonstrating that Ligado’s offering would cause significant harmful interference to Iridium’s reliable, ubiquitous satellite communications services.⁶ And the National Telecommunications and Information Administration (“NTIA”), the Department of Defense (“DOD”), the Department of Transportation (“DOT”), and others demonstrated that Ligado’s services would pose an unacceptable risk to both military and civilian applications of the GPS. The FCC disregarded all this evidence, proceeding instead under the erroneous premise that the harmful interference either will not occur or can readily be remedied through party-to-party negotiations. This premise is incorrect in multiple respects.

⁵ *Id.* See also 5 U.S.C. § 557(c)(3)(A); *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 416 (1971).

⁶ See Technical Analysis of Ligado Interference Impact on Iridium User Link, IB Docket Nos. 11-109, 12 -340 (“Iridium User Link Analysis”), attached to Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Sept. 1, 2016); Technical Analysis of Ligado Interference Impact on Iridium Aviation Services, IB Docket Nos. 11-109, 12-340 (“Iridium Aviation Services Analysis”), attached to Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Dec. 14, 2016); Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Oct. 2, 2019) (“Iridium Oct. 2 Letter”).

A. The Commission Improperly Rejected Parties’ Filings and Analyses Demonstrating Harmful Interference Arising from Ligado’s Operations.

The *Order* repeatedly dismisses concerns regarding likely interference on the flimsiest of grounds, uncritically regurgitating Ligado’s claims and rejecting in conclusory fashion technical analysis by Iridium, NTIA, and DOD proving harm caused by Ligado’s operations.

1. The Order Improperly Retained the 2005 OOB Limits to “Protect” Iridium.

Much of the *Order*’s interference analysis hinges on its unexplained – and unsupportable – choice to apply the out-of-band emissions (“OOBE”) limits set out in its 2005 *ATC Order on Reconsideration*,⁷ notwithstanding record evidence that those limits were premised on deployment assumptions (in particular, aggregate emission levels) that no longer apply.

In the 2005 *ATC Order*, the Commission declined to limit the number of permissible ATC terminals because it was adopting “an overall limitation on the amount of interference an MSS/ATC system can cause to another [mobile satellite system (‘MSS’)] system in the L-band.”⁸ The chosen limit, adopted with substantial input from Ligado,⁹ presumed that Ligado would serve a total customer base of between 10 and 18 million customers.¹⁰ Ligado’s ’s 2005 analysis showed that the aggregate emissions associated with 9 million ATC terminals nationwide would have only a “negligible” impact on MSS operators.¹¹ But it recognized that if

⁷ *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, 20 FCC Rcd 4616 (“2005 ATC Order”).

⁸ *Id.* at 4634 ¶¶ 48-49.

⁹ See Consolidated Opposition to and Comments on Petitions for Reconsideration of Mobile Satellite Ventures Subsidiary LLC, IB Docket No. 01-185, at 8-9 (filed Aug. 20, 2003) (“2003 MSV Opposition”).

¹⁰ See, e.g., Letter from David S. Konczal, Counsel to Mobile Satellite Ventures Subsidiary LLC, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 01-185, IBFS File Nos. SAT-MOD-20031118-00333 et al. (filed May 21, 2004) (indicating expected customers across MSV services).

¹¹ See, e.g., 2003 MSV Opposition at 9.

an ATC operator proposed to deploy more terminals, “an appropriate limit on simultaneously transmitting ATC mobile terminals” might be needed.¹²

Fifteen years later, the system Ligado claims it will deploy today could include vastly more base stations and user terminals than contemplated in 2005, with potentially massive aggregate impact on other MSS operators. By some estimates there will be 4.6 billion networked devices in the United States alone by 2023.¹³ Even if Ligado provides connectivity to only a small fraction of these devices, its deployment would dwarf the deployment assumed by Ligado, the Commission, and others in 2005, and – as the Commission and Ligado recognized in 2005 – necessitate reassessment of the OOB limits.¹⁴ The *Order* failed to account for these arguments, or otherwise to justify the application of 2005 limits in 2020.

Strikingly, the *Order* does not respond to any of Iridium’s concerns or cite *any* technical analysis showing that application of the 2005 emissions limit will adequately protect Iridium – a fatal error even if no party had submitted *any* contrary analysis. The Commission and Ligado had years in which they might have conducted such studies, even following Ligado’s most recent amendments. Their failure to do so, and the resulting hole in the *Order*’s reasoning, constitute reversible error.

¹² Opposition of Mobile Satellite Ventures Subsidiary LLC to Petition for Partial Reconsideration and Clarification of Inmarsat Ventures LTD, IB Docket No. 01-185, at 9-10 (Aug. 4, 2005).

¹³ See Cisco, Annual Internet Report Highlights Tool, <https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/air-highlights.html#> (last visited May 21, 2020).

¹⁴ See, e.g., Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340, IBFS File Nos. SAT-AMD-20180531-00045 et al. (filed Aug. 26, 2019) (“Iridium Aug. 26 Letter”).

2. *The Order Improperly Dismissed Iridium’s Technical Analysis.*

In 2016, Iridium submitted a two-part technical analysis showing that, based on reasonable estimates concerning the number of simultaneously operating Ligado user devices, Ligado’s terrestrial operations would undoubtedly cause harmful interference to Iridium across a range of deployment scenarios.¹⁵ Rather than contending with this analysis, including by applying its new OOB limit to the study or seeking comment asking Iridium and others to do so, the Commission simply rejected it in its entirety, citing three grounds – none of which withstands even minimal scrutiny. First, the Commission states that the study was conducted at the power levels proposed by Ligado in its modification application rather than the power levels the agency ultimately authorized in the *Order*. That is correct, but it only highlights the *Order*’s unlawfulness. “An agency commits serious procedural error when it fails to reveal portions of the technical basis for a proposed rule in time to allow for meaningful commentary,” treating “what should be a genuine interchange as mere bureaucratic sport.”¹⁶ The Commission violated that principle here by failing to provide Iridium an opportunity to comment on the power levels that the Commission adopted, rather than those proposed by Ligado, and then penalizing Iridium for not guessing the power level the *Order* would permit.

In any case, Iridium’s analysis proves that Iridium would incur substantial harms from Ligado’s operations *even at the adopted OOB limits*. This would have been evident had the Commission consulted Iridium’s study. The Commission could simply have applied the analysis subtracting the additional 9 dB (*i.e.*, using -67 dBW rather than -58 dBW). Alternatively, it could have requested revised analysis reflecting the change. Either way, it would have seen that,

¹⁵ See Iridium User Link Analysis.

¹⁶ *Conn. Light & Power Co. v. Nuclear Regulatory Comm’n*, 673 F.2d 525, 530-31 (D.C. Cir. 1982).

at the reduced power levels in the *Order*, Ligado’s operation of even a single handset in line of sight would continue to cause substantial harmful interference at just over a kilometer away from an Iridium handset. The revised version of the study appended to this petition as Attachment 1 confirms this point.

Second, in a mere half-sentence, the Commission contends that Iridium employed unduly conservative assumptions as to path loss.¹⁷ As Iridium demonstrated, however, it was appropriate to assume free-space path loss to establish a baseline upper bound on the interference, because there are numerous contexts in which Iridium and Ligado terminals would be near and within line-of-sight of one another – contexts that would not be covered by an urban propagation model.¹⁸ Indeed, Section 25.253 of the Commission’s rules states in three instances that free-space path loss “must be assumed” in computing power flux density.¹⁹ The *Order* offers no response: it does not set out what a proper path loss assumption might be; does not attempt to rerun the analysis (or conduct its own) based on that assumption; and does not explain its repudiation of Section 25.253. In relying on “bald assertion[s]” rather than sound analysis, the Commission disregarded its responsibility to “take[] a ‘hard look’ at the salient problems, and ... engage[] in reasoned decision-making.”²⁰ Furthermore, Iridium’s analysis utilized the Hata-Okumura propagation model, which is commonly used for land mobile applications and was considered in similar Ligado interference studies. As Iridium showed, the propagation

¹⁷ *Lightsquared Technical Working Group Report et al.*, Order and Authorization, FCC 20-48 ¶ 117 (rel. Apr. 22, 2020) (“*Order*”).

¹⁸ See Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340, at 3-4 (filed Mar. 27, 2017); Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340, at 2-3 (Dec. 14, 2016).

¹⁹ 47 C.F.R. § 25.253.

²⁰ *Loyola University v. FCC*, 670 F.2d 1222, 1227 (D.C. Cir. 1982). See also *Public Citizen v. National Highway Traffic Safety Admin.*, 848 F.2d 256, 266-267 (D.C. Cir. 1988).

model used resulted in path losses that were significantly higher those than found assuming free-space path loss.

Third, the *Order* asserts – again in an unsupported half-sentence – that “Iridium uses conservative assumptions with respect to the number of simultaneous interfering signals (assumed to be 18 [per LTE cell (base station)]).”²¹ To begin with, that is academic, because Iridium will experience interference from even just *one* Ligado terminal.²² At any rate, Iridium’s assumption was drawn from a CSMAC Working Group 1 (“WG-1”) report, wherein diverse industry stakeholders, including two representatives from Ligado, agreed that 18 simultaneous users per LTE cell was “typical.”²³ Given Ligado’s shift toward IoT connectivity, which is expected to connect millions of previously unconnected devices, one might well expect far *more* devices in use than are assumed by Iridium’s model. Notably, the Commission makes no effort to quantify how many Ligado devices it believes might be in operation at any time (an arbitrary failure in its own right), and its implicit assumption that there will be relatively few Ligado devices contradicts its public benefit finding, which credits Ligado’s claim that its offerings will be widely adopted.²⁴ Such unexplained inconsistency is plainly arbitrary and capricious.

Iridium also introduced analysis demonstrating that Ligado’s terrestrial operations would interfere with the vital operator datalink services Iridium provides to aircraft and to its aeronautical mobile satellite (route) service (“AMS(R)S”), which supports safety-critical datalink services for air traffic control, among others.²⁵ Interference to aviation systems is, if anything,

²¹ *Order* ¶ 117.

²² *See* Iridium User Link Analysis at 18-19.

²³ Commerce Spectrum Management Advisory Committee, *Working Group 1 – 1695-1710 MHz Meteorological-Satellite*, Final Report, at App. 3 (Jan. 22, 2013) https://www.ntia.doc.gov/files/ntia/publications/wg_1_report.pdf.

²⁴ *See Order* ¶¶ 21-22.

²⁵ Iridium Aviation Services Analysis at 2. *See also* Iridium Oct. 2 Letter.

more likely than it is to ground-based receivers, because there are no obstacles resulting in propagation losses between the Ligado terminal and the Iridium receiver. Moreover, because AMS(R)S communications “relate to the safe, efficient and economical operation of aircraft, such as fuel, weather, position reports, aircraft performance, essential services and supplies,”²⁶ harmful interference to AMS(R)S could have life-or-death consequences. Yet the *Order* simply ignores these matters, irrationally denies Iridium’s request for exclusion zones around airports, and treats interference to AMS(R)S and other Iridium MSS services as though they were alike.

3. *The Order Gave Inadequate Consideration to the Concerns of Other Federal Stakeholders.*

The *Order* is similarly dismissive of the interference concerns raised by the executive branch, including especially NTIA, DOT, and DOD, each of which has a statutory (and indeed constitutional) role in spectrum decisions. First, the *Order* flouts statutory directives and the Commission’s own precedent regarding NTIA’s role. Congress designated NTIA to serve as the President’s “principal advisor” on telecommunications policy, to manage the government’s use of spectrum resources, and to represent the views of the “executive branch” before the FCC on issues regarding spectrum use.²⁷ Congress also directed the Commission to coordinate with NTIA to avoid “harmful interference.”²⁸ Accordingly, the 2003 Memorandum of Understanding (“MOU”) between the FCC and NTIA states that the two bodies will resolve technical and policy differences by consensus whenever possible.²⁹ Thus, in previous cases in which NTIA has indicated that it did not support a proposed FCC action, the Commission has heeded NTIA’s

²⁶ *Review of Part 87 of the Commission’s Rules Concerning the Aviation Radio Service*, 16 FCC Rcd 19005, 19008 ¶ 5 (2001). *See also* Reply Comments of Iridium Communications Inc., IB Docket Nos. 11-109, 12-340, at 5-7 (filed June 21, 2016) (discussing same).

²⁷ 47 U.S.C. § 902.

²⁸ *Id.* § 922(4).

²⁹ Memorandum of Understanding between the FCC and NTIA, at Section IV(5) (Jan. 31, 2003), <https://docs.fcc.gov/public/attachments/DOC-230835A2.pdf>.

concerns.³⁰ Not so here. NTIA repeatedly raised objections – in 2012,³¹ in 2014,³² in 2019,³³ and finally last month – stating that the Commission “cannot reasonably” conclude that “harmful interference concerns have been resolved.”³⁴ Similarly, Congress directed the DOT (in coordination with DOD) to help ensure the availability of GPS for civilian purposes,³⁵ and its views were expressed in various NTIA filings. The *Order* neither accommodates nor engages with these concerns, and evinces no regard for NTIA’s and DOT’s own statutory prerogatives.

NTIA’s views presented an “important aspect of the problem,” so the Commission had to address them even under ordinary circumstances.³⁶ But the FCC’s disregard for NTIA’s views is especially problematic given the Commission’s independent status, which renders its obligation to engage in reasoned decision-making “all the more important.”³⁷ And because the views it disregarded were those of the executive branch – including the President’s principal advisor on telecommunications policy (NTIA) and one of the principal national security agencies (DOD) – the attention due was especially great. If the Communications Act permitted the superficial

³⁰ See, e.g., *Allocations and Service Rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, 18 FCC Rcd 23318, 23333-35, ¶¶ 33-37 (2003); *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, 34 FCC Rcd 5134 (2019).

³¹ Letter from Lawrence E. Strickling, NTIA, to Julius Genachowski, Chairman, FCC, ET Docket No. 12-338 (filed Feb. 14, 2012).

³² Letter from Karl B. Nebbia, NTIA, to Julius P. Knapp, Chief, Office of Engineering Technology, FCC (filed Mar. 10, 2014).

³³ Letter from Douglas W. Kinkoph, NTIA, to Ajit Pai, Chairman, FCC, IB Docket Nos. 11-109 and 12-340 (filed Dec. 6, 2019) (“NTIA December 6, 2019 Letter”).

³⁴ Letter from Douglas W. Kinkoph, NTIA, to Ajit Pai, Chairman, FCC, IB Docket Nos. 11-109 and 12-340 (filed Apr. 10, 2020).

³⁵ See *id.* § 2281(b), (c).

³⁶ *State Farm*, 463 U.S. at 43.

³⁷ *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 547 (2009) (Breyer, J., dissenting).

attention that the *Order* accords the executive branch’s views, the Act would unconstitutionally encroach on the President’s authority to supervise executive activity.³⁸

Second, apart from any heightened deference due the views of the executive branch generally, the Commission exceeded its authority in brushing aside concerns raised by DOD and DOT. Congress vested in DOD the authority to safeguard GPS for military purposes.³⁹

Congress explicitly empowered DOD to protect GPS against “hostile” interference,⁴⁰ and (in its role in providing for “civil, commercial, and scientific uses” of GPS) to oppose “regulatory” actions by any other “agency” that “would adversely affect [GPS’s] military potential.”⁴¹ Those specific directives reflect Congress’s presupposition of DOD’s authority to ensure the military effectiveness of GPS – an authority that supersedes the FCC’s authority to allocate spectrum. If the Communications Act allowed the Commission – an independent agency – to allow interference with the military use of GPS without reasonably resolving DOD’s national-security based objection, the Act would unconstitutionally infringe “the President’s role as Commander in Chief.”⁴² To avoid such a serious constitutional concern, the Commission should interpret the relevant statutes to require it to reasonably resolve DOD’s concerns.

The Commission did not do that here. DOD stressed “the importance of building a more lethal force and strengthening (interoperable) alliances and partnerships,” noting that “GPS is

³⁸ See *Free Enter. Fund v. Pub. Co. Accounting Oversight Bd.*, 561 U.S. 477, 492-498 (2010); cf. *Humphrey’s Executor v. United States*, 295 U.S. 602 (1935). Iridium preserves for further review the position that *Humphrey’s Executor* should not be extended to permit the FCC to make national security decisions free of supervision by the President and in disregard of the views of the executive branch. If *Humphrey’s Executor* permits that result, it should be overruled.

³⁹ 10 U.S.C. § 2281(a).

⁴⁰ *Id.* § 2281(a)(1)-(2).

⁴¹ *Id.* § 2281(b)(5).

⁴² *PHH Corp. v. Consumer Fin. Prot. Bureau*, 881 F.3d 75, 107 (D.C. Cir. 2018) (*en banc*).

one such space capability.”⁴³ DOD further explained that “FCC approval of Ligado’s license modification would cause unacceptable operational impacts and adversely affect the military potential of GPS,”⁴⁴ and that there were “no practical measures to meaningfully mitigate” the “unacceptable” impacts of the FCC’s approval.⁴⁵ The approval, DOD also warned, could set back efforts to “respond to rapidly evolving threats *by decades*.”⁴⁶ As with NTIA’s input, however, the *Order* gave DOD’s concerns the back of the hand. Among other things, the Commission wrongly asserts that commercial uses and military uses have the same tolerance for potential harmful interference, when in fact DOD aviation operations may differ from civil aviation concerns, given that DOD often operates aircraft and airfields entirely within its control, and dismisses DOD’s concern about how many systems would be affected by a grant.⁴⁷ The FCC also blithely assumes that any interference problem can be addressed through a process in which DOD provides Ligado detailed information regarding defense systems, allowing Ligado to assess interference. This assumption ignores both the national security concerns raised by such a process and DOD’s conclusion that it would be “practically impossible” to identify all affected devices.⁴⁸ DOT’s concerns fared little better. In these ways, the Commission impermissibly

⁴³ Memorandum for IRAC Chairman, Department of the Air Force, at 3 (Feb. 14, 2020) (emphasis added) (“Air Force Memo”).

⁴⁴ Letter from Dana Deasy, DOD Chief Operation Officer, and Michal Griffin, Under Secretary of Defense for Research and Engineering, to Douglas W. Kinkoph, NTIA, at 1 (Mar. 12, 2020); Air Force Memo at 1.

⁴⁵ *Id.*

⁴⁶ *Id.* at 5 (emphasis added).

⁴⁷ *Order* ¶¶ 97-106.

⁴⁸ It appears that the Commission did not even work to better understand the executive branch’s discomfort – for example, by asking for a classified briefing regarding DOD’s national security concerns, as more than 20 members of the House Armed Service Committee proposed in their May 7 letter. Letter from Adam Smith, Chairman, House Armed Services Committee, et. al., to Ajit Pai, Chairman, FCC, *et al.*, at 1-2 (filed May 7, 2020). It was arbitrary for the Commission to disregard the national concerns of the military simply because underlying data were classified.

supplanted the views of the executive branch on critical matters expressly reserved to the President.

B. Having Recognized that Some Harmful Interference Will Occur, The *Order* Unlawfully Failed to Satisfy Section 343’s Requirements.

Section 343 of the Act provides that “[t]he Commission shall not permit commercial terrestrial operations in the 1525–1559 megahertz band or the 1626.5–1660.5 megahertz band until the date that is 90 days after the Commission *resolves* concerns of widespread harmful interference by such operations in such band to covered GPS devices.”⁴⁹ The Commission’s claim that it has satisfied this requirement merely by directing Ligado to work with other parties to resolve such concerns⁵⁰ is wrong. Nothing in the *Order* requires Ligado to replace or repair equipment when GPS providers (including DOD) believe interference is likely. Indeed, if Ligado disagrees about the likelihood of interference, the *Order* creates no obligation for Ligado to take any action to address that interference. Thus, the Commission has failed to satisfy its statutory duty to “resolve[]” such interference.

Indeed, the Commission seems to misunderstand what it means to “resolve” a concern about harmful interference. The *Order* concludes that adjacent-band operations will be “*sufficiently* protected from harmful interference,” and that “the Commission’s responsibility [is] to ensure that Ligado’s revised proposal *sufficiently* protects against harmful interference to other services.”⁵¹ The Act does not require the Commission to “sufficiently” resolve harmful interference, but to *resolve* it.

⁴⁹ 47 U.S.C. § 343(a) (emphasis added).

⁵⁰ *Order* ¶ 130.

⁵¹ *Id.* ¶¶ 1, 34 (emphasis added).

C. The Commission Similarly Failed to Apply Section 25.255 of its Rules.

The *Order* also contradicts the Commission’s established ATC rules, which require *the ATC provider* – here, Ligado – to remedy such interference in the first instance. Section 25.255 provides that “[i]f harmful interference is caused to other services by ancillary MSS ATC operations ... the MSS ATC operator must resolve any such interference.”⁵² That provision reflects the Commission’s determination that the *ATC operator* bears a duty to resolve harmful interference, even if the operator otherwise complies with applicable technical rules, because the L-band allocation “remains first and foremost a satellite service.”⁵³ It also makes clear that the obligation applies to *any* “harmful interference [that] is caused to other services,” irrespective of whether that interference affects MSS, GPS, or other offerings.⁵⁴

Consistent with the rule’s text, the Commission routinely has interpreted Section 25.255 as placing an “absolute obligation” to “resolve any ... interference” to any “other services” on the ATC operator itself – *not*, in whole or in part, on the entity whose operations will face interference.⁵⁵ This is why the International Bureau required Ligado’s predecessor to address GPS interference concerns “to the Commission’s satisfaction,”⁵⁶ why the FCC Chairman cited Section 25.255 in 2012 as a basis for requiring the company to resolve GPS interference,⁵⁷ and

⁵² 47 C.F.R. § 25.255.

⁵³ See *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands etl al.*, 18 FCC Rcd 1962, 1979-80, ¶ 31 (2003) (“2003 ATC Order”).

⁵⁴ 47 C.F.R. § 25.255.

⁵⁵ See, e.g., *Spectrum & Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands; Globalstar Licensee LLC, Auth. to Implement an Ancillary Terrestrial Component*, 23 FCC Rcd 7210, 7223 ¶ 35 (2008) (“Our rules impose an absolute obligation on the MSS/ATC operator to resolve any harmful interference to other services.”).

⁵⁶ See *LightSquared Subsidiary LLC*, 26 FCC Rcd 566, 586, ¶ 41 (IB 2011).

⁵⁷ See Letter from Julius Genachowski, FCC Chairman, to Cliff Stearns, Committee on Energy and Commerce, U.S. House of Representatives, at 1 & n.1 (Mar. 23, 2012).

why the Commission sought further comment in 2016 on whether “there remains potential for harmful interference from the proposed terrestrial operations ... [at] 1627.5-1637.5 MHz.”⁵⁸

The *Order* turns this framework on its head. Despite robust discussion of the rule in the record, the Commission mentions Section 25.255 only once, merely to assert (without support) that Ligado will cure any interference caused to other services.⁵⁹ But rather than requiring Ligado to do so, it merely “encourage[s] Iridium and Ligado ... to engage in further discussions to address any use cases that may present unique interference concerns ... with the aim of concluding arrangements that may be satisfactory to both parties.”⁶⁰ This language transforms Section 25.255 from a legal obligation into a mere aspiration. Moreover, the Commission effected this change without recognizing, much less justifying, its change in approach. “An agency may not ... depart from a prior policy *sub silentio* or simply disregard rules that are still on the books,” but rather must “show that there are good reasons for the new policy.”⁶¹ The *Order* does neither, and for this reason and others cannot stand.

D. The *Order* Improperly Determined that the Conditions Imposed Would Adequately Resolve Interference Concerns.

The *Order* also unreasonably concluded the conditions would resolve interference concerns. In the first instance, the *Order* invokes private agreements that Ligado reached with some GPS providers, indicating that other parties can reach similar settlements. The Commission’s hope that parties like Iridium – whose interests and concerns differ greatly from those of the GPS providers – will reach agreement with Ligado after failing to do so over the vast lifespan of this proceeding reflects an abdication of the Commission’s responsibility to protect

⁵⁸ *Comment Sought on Ligado’s Modification Applications*, 31 FCC Rcd 3802, 3811-12 (IB 2016).

⁵⁹ *Order* ¶ 118.

⁶⁰ *Id.*

⁶¹ *Fox Television Stations, Inc.*, 556 U. S. at 515.

licensees from harmful interference and absolves Ligado of its duty to resolve harmful interference it causes. For one thing, Ligado’s agreements with GPS providers afford only collateral protection to Iridium.⁶² Moreover, the *Order*’s suggestion that its imposition of a new power limitation in the band adjacent to Iridium appropriately responds to the absence of an Iridium/Ligado agreement⁶³ is a non-sequitur; the power reduction, while an improvement, will not cure the harmful interference at issue.⁶⁴ And if Ligado showed no interest in meaningfully remedying expected interference while its applications were pending, there is no reason to think it has any incentive to reach arrangements that are “satisfactory to both parties” now, with or without the agency’s “encourage[ment].”

The *Order*’s proposed mitigation mechanisms with regard to military uses fare no better. Again, agreements between Ligado and commercial GPS interests do not speak to whether Ligado can adequately address the military’s unique concerns.⁶⁵ Further, as noted, the *Order* does not require Ligado to take action if it disagrees with DOD as to interference. Even after quoting the Air Force’s statement that it would be “practically impossible” to identify all affected devices,⁶⁶ it requires DOD to do *precisely that*.⁶⁷ It also fails to acknowledge that DOD might

⁶² The *Order* specifies a power level of -7 dBW in the 1627.5-1637.5 MHz and the 1646.5-1656.5 MHz uplink bands, but mandates that, “*for a period of five years, the maximum EIRP*” for 1627.5-1632.5 MHz “will ramp up from -31 dBW at 1627.5 MHz to -7 dBW at 1632.5 MHz.” *Order* ¶ 135 (emphasis added). This passage clearly intends to institute a five-year ramp-up beginning from date of the order. A reading under which the ramp-up period commenced upon the dates of Ligado’s agreements with GPS providers would be internally inconsistent (those agreements were executed on different dates), would contradict the passage’s plain language (“*will ramp up*”), and would eviscerate any “protections” afforded by the power limits. To avoid any unnecessary dispute if the Commission were to uphold any portion of the *Order* relating to this ramp-up, Iridium respectfully seeks confirmation of its interpretation.

⁶³ See *Order* ¶ 63.

⁶⁴ See *supra* Part I.A.1-I.A.2.

⁶⁵ See Air Force Memo at 3-4.

⁶⁶ Air Force Memo at 3, *quoted by Order* ¶ 105.

⁶⁷ See *id.* ¶ 103.

have well-founded concerns about sharing information regarding shortcomings in sensitive military equipment with Ligado, a private actor.⁶⁸

Even aside from these problems, the Commission’s directive that Ligado replace or repair DOD devices runs afoul of the Miscellaneous Receipts Act (“MRA”). The MRA requires “an official or agent of the Government receiving money for the Government from any source [to] deposit the money in the Treasury as soon as practicable without deduction for any charge or claim.”⁶⁹ Under the MRA, DOD would be required to deposit any funds it might receive from Ligado into the Treasury, rather than using it to address interference. Although the *Order* uncritically parrots and accepts Ligado’s claim that its plan falls within exceptions to the MRA’s terms, none of the three “authorities” Ligado cites actually supports its claim.⁷⁰ Thus, the *Order*’s supposed remedies will not cure harmful interference in either the civilian or military contexts.

⁶⁸ See Air Force Memo at 1.

⁶⁹ 31 U.S.C. § 3302(b).

⁷⁰ See *Order* ¶ 99. In *Maritime Administration—Disposition of Funds Recovered from Private Party for Damage to Gov’t Bldg.*, B-287738, 2002 WL 1554364, at 3-4 (May 16, 2002), GAO held that monetary compensation received from a contractor for damage it caused to government “must be deposited into the Treasury as a miscellaneous receipt.” *Id.* Thus, that decision actually opposes the *Order*’s approach. Indeed, GAO proceeded to review a series of decisions *rejecting* plans mirroring Ligado’s proposal on the grounds that they would violate the MRA. See *id.* *LCPtracker, Inc.; eMars, Inc.*, does not relate to, or even mention, the MRA. And *General Services Administration: Real Estate Brokers’ Commissions* is inapposite because it contemplated a situation in which the government would benefit from real-estate brokerage services, whereas Ligado’s proposal for the “updating (e.g., retrofit with improved antennas), repair, or replacement” of equipment would necessarily involve the provision of goods or funds, unless DOD were to afford Ligado access to its most sensitive facilities.

E. The Commission Improperly Disregarded Evidence of the Economic Effects of Interference from Ligado’s Operations.

Finally, while the FCC’s leadership has stated that it is “time to restore the place of economic analysis at the FCC”⁷¹ and committed “to make sure economics does in fact play a larger role” in agency decisions,⁷² the *Order* is bereft of economic discussion, and gives no consideration to the *tens of billions of dollars* the multiple high-value services based in the relevant portion of the L-band generate for the U.S. economy every year – benefits that will be compromised by Ligado’s terrestrial operations.⁷³ The record showed that interference from Ligado will compromise Iridium’s \$3 billion investment in its new and upgraded 66-satellite Iridium NEXT constellation.⁷⁴ Further, Ligado’s proposal to modify or replace affected military GPS receivers, “even if a solution were shown to be feasible, could take on the order of billions of dollars.”⁷⁵ And a GPS outage could cost the U.S. economy more than \$1 billion per day.⁷⁶ The *Order* failed to address these harms or any other economic evidence.

⁷¹ See Ajit Pai, Chairman, FCC, Remarks at the Hudson Institute, *The Importance of Economic Analysis at the FCC*, at 2 (Apr. 5, 2017).

⁷² See *Establishment of the Office of Economics and Analytics*, 33 FCC Rcd 1539, 1548 (2018).

⁷³ See Letter from Patrick R. Halley, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Sept. 27, 2018).

⁷⁴ See Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Apr. 9, 2019); Letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Sept. 6, 2019). More recently, Iridium launched the Iridium Certus service, which delivers broadband voice and data services to customers in maritime, aviation, and land mobile markets. See, e.g., Iridium, Press Release, *Iridium Certus(SM) Goes Live; World's First Truly Global Broadband Service* (Jan. 16, 2019), <https://investor.iridium.com/2019-01-16-Iridium-Certus-SM-Goes-Live-Worlds-First-Truly-Global-Broadband-Service>.

⁷⁵ Air Force Memo at 5.

⁷⁶ See RTI International, *Economic Benefits of the Global Positioning System (GPS)*, Final Report, RTI Project Number 0215471, at 14-1 to 14-13 (June 2019), https://www.rti.org/sites/default/files/gps_finalreport.pdf. The Coalition of Aviation SATCOM and Weather Information Users (“Coalition”) submitted for the record a study commissioned by the Department of Commerce’s National Institute of Standards and Technology that also estimated that GPS has generated \$1.4 trillion in U.S. economic benefits since it was made available for civilian use.

II. THE COMMISSION ERRONEOUSLY DETERMINED THAT AUTHORIZATION OF LIGADO’S APPLICATION WOULD YIELD PUBLIC INTEREST BENEFITS.

Notwithstanding the unusual length of the underlying proceeding, which produced thousands of pages of filings, the 154-paragraph *Order* allocated merely *six* paragraphs to the critical question whether a grant would engender any public interest benefits. Those paragraphs manage to incorporate numerous errors and reveal breathtaking deference to the applicant’s unsupported claims based on speculative, ill-defined operational plans that the Commission never required Ligado to commit to, while ignoring the wealth of record evidence casting doubt on those claims. Moreover, although commenters noted that Ligado had provided no serious cost/benefit analysis,⁷⁷ the *Order* never mentioned, much less resolved, any of these concerns.

The *Order*’s public-interest discussion is based not on analysis of the claimed benefits, but rather on a rote, reflexive recitation of Ligado’s advocacy points. For example, the *Order*’s assertion that Ligado “has the potential to improve the 5G user experience”⁷⁸ ignores the fact that, after years of promises, there is no record evidence that Iridium has formally initiated the process to be included in the 3GPP standards for 5G.⁷⁹ The *Order* also fails to mention that the L-band is not globally harmonized for 5G or acknowledge NTIA’s statement that deployment of Ligado’s spectrum is not necessary for “the timely deployment of 5G across the United States.”⁸⁰ The Commission cites a Ligado filing quoting what it calls “studies” from Nokia and Ericsson conducted in June 2019 to establish some link between Ligado’s offering and 5G,⁸¹ but these

⁷⁷ Letter from Irving Leveson, Ph.D. to Marlene Dortch, Secretary, FCC, RM-11681 *et al.*, at 2 (filed Aug. 22, 2017).

⁷⁸ *Order* ¶ 23.

⁷⁹ See Iridium Aug. 26 Letter at 3-4.

⁸⁰ Letter from Douglas W. Kinkoph, Deputy Assistant Secretary for Communications and Information (Acting), to Ajit Pai, Chairman, FCC, IB Docket No. 11-109 at 2 (filed Dec. 6, 2019).

⁸¹ *Order* ¶ 23.

documents, first submitted in December 2019,⁸² were not “studies” at all. Rather, they were high-level talking points touting potential use cases for Ligado’s service, devoid of any technical detail or explanation of the basis for their conclusions. The Commission’s willingness to accept Ligado’s “just trust us” assertions at face value contradicts the agency’s repeated claims that public benefit findings require more than theoretical or speculative proclamations⁸³ and that it will “discount or dismiss speculative benefits that we cannot verify.”⁸⁴

Tellingly, even after granting Ligado the benefit of every doubt, and ignoring all record evidence to the contrary, the best the *Order* can do is say that “Ligado’s proposed service *could* develop as a key infrastructure component of the digital economy.”⁸⁵ Setting aside the equivocation, this finding had no evidentiary basis – it was, instead, pure speculation grounded in Ligado’s puffery. The APA requires the Commission to “engage in ‘reasoned decision-making,’ taking a ‘hard look’ at the salient problems” before it,⁸⁶ and its conclusions may not be supported, as here, by “evidence” that is “speculative” or “conclusory.”⁸⁷ The *Order*’s perfunctory public-interest analysis fails on all counts.

⁸² See Ericsson, *Ligado UL and DL Decoupling study*, Project Report, and Nokia Technologies, *Nokia’s Study on Ligado Lower Mid-Band Spectrum Solution to Address 5G Deployment Challenges* (June 2019), attached to Letter from Gerard J. Waldron, Counsel to Ligado, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 11-109 (Dec. 16, 2019).

⁸³ See, e.g., *Applications of AT&T Inc. and DIRECTV*, 30 FCC Rcd. 9131, 9237 ¶ 274 (2015) (“[A] claimed [merger] benefit must be verifiable,” and applicants bear “the burden of providing sufficient evidence to support each claimed benefit”).

⁸⁴ *Consent to Transfer Control of License Subsidiaries of Media General, Inc., from Shareholders of Media General, Inc. to Nexstar Media Group, Inc. et al.*, 32 FCC Rcd 183, 193 ¶ 23 (WTB 2017) (citation omitted). See also *Applications of AT&T Inc. and Deutsche Telekom AG*, 26 FCC Rcd 16184, 16297 (WTB 2011); *Applications of Nextel Communications, Inc. and Sprint Corporation*, 20 FCC Rcd 13967, 14030 ¶ 169 (2005).

⁸⁵ *Order* ¶ 21 (emphasis added).

⁸⁶ *Panhandle Eastern Pipe Line Co. v. FERC*, 890 F.2d 435, 439 (D.C.Cir. 1989), quoting *ANR Pipeline Co. v. FERC*, 771 F.2d 507, 516 (D.C.Cir. 1985), *Consolidated Edison Co. v. FERC*, 823 F.2d 630, 637 (D.C.Cir. 1987).

⁸⁷ *Schofield v. Saul*, 950 F.3d 315, 320 (5th Cir. 2020). See also *Thompson v. Potomac Elec. Power Co.*, 312 F.3d 645, 649 (4th Cir. 2002).

III. THE COMMISSION ERRONEOUSLY WAIVED THE INTEGRATED SERVICE RULE.

The Commission also erred in waiving the ATC “integrated service” rule. It failed to demonstrate good cause for the waiver, and erroneously concluded that the waiver would advance the goals of the ATC gating criteria.

To begin with, the Commission incorrectly granted a waiver of the integrated service rule rather than conduct a rulemaking. As the agency has explained: “[A] waiver is not the appropriate vehicle to effect a substantial change in the permissible use and eligibility rules for a block of spectrum, which requires a more thorough study of the spectrum, including consideration of other possible uses of the spectrum. This sort of fundamental change is the province of rulemaking.”⁸⁸ This principle has guided the Commission toward rulemaking rather than adjudication in other cases where satellite operators have sought relief from the ATC integrated service rule,⁸⁹ and should have guided the Commission here.⁹⁰

The Commission also failed to satisfy the legal criteria for a waiver. To justify a waiver, the Commission must show “good cause” for abstaining from enforcement of the rule at issue.⁹¹ The D.C. Circuit has held that, to demonstrate good cause, the Commission must (1) “explain why deviation better serves the public interest” and (2) “articulate the nature of the special circumstances to prevent discriminatory application and to put future parties on notice as to its

⁸⁸ *Waiver Requests by Clarity Media Systems, LLC, to Operate CARS Stations at Flying J Travel Plazas*, 28 FCC Rcd 9629, 9634 ¶ 14 (2013) (citations omitted).

⁸⁹ *See, e.g., DBSD North America, Inc., Debtor-in-Possession; New DBSD Satellite Services G.P., Debtor-in-Possession et al.*, 27 FCC Rcd 2250, 2261-62 ¶ 29 (IB 2012); *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks et al.*, 28 FCC Rcd 15351, 15361-62 ¶ 26 (2013).

⁹⁰ Iridium has twice asked the Commission to revise its ATC rules. *See* Comments of Iridium, CB Docket No. 18-31 & IB Docket No. 16-131 (filed Oct. 29, 2018); Comments of Iridium, IB Docket No. 18-377 (filed Jan. 17, 2019). The Commission has not responded to these requests.

⁹¹ 47 C.F.R. § 1.3.

operation.”⁹² The grounds on which the waiver is granted must be explicitly stated⁹³ and easily understood – “[i]f they are opaque, the danger of arbitrariness (or worse) is increased.”⁹⁴

The *Order* failed to satisfy these criteria. Indeed, the Commission makes no effort to explain why the requested “deviation” “better serves the public interest” than requiring Ligado to adhere to the rule, or to “articulate the nature of the special circumstances to prevent discriminatory application and to put future parties on notice as to its operation.”⁹⁵

Nor could the FCC satisfy these criteria. First, the waiver will undermine the public interest by authorizing a departure from decades of spectrum stability and protection for valuable satellite services in the L-band. The L-band has evolved over the last 30 years to include three key satellite services: GPS; the NOAA Geostationary Operational Environmental Satellites (“GOES”), which provide positional, timing, and weather data directly to users all across the U.S.; and satellite communications services provided by companies like Iridium. Stability in L-band allocations and protection from harmful interference have enabled these services to thrive, generating significant investment in L-band satellite services and the proliferation of new, valuable services. The *Order* does not consider how waiver will undermine the public interest in these incumbent services, or the public interest benefits that would result from the satellite services using Ligado’s spectrum if it is not converted to terrestrial use.

The *Order*’s blanket reliance on the 2011 waiver does not help the Commission, either. In the ensuing nine years, Ligado has failed meaningfully to upgrade its MSS services, the proliferation of terrestrial devices has heightened the risks associated with Ligado’s proposed

⁹² *Northeast Cellular Tel. Co., L.P. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

⁹³ *See Keller Comm’cns, Inc. v. FCC*, 130 F.3d 1073, 1076 (D.C. Cir. 1997) (agency “must clearly state in the record its reasons for granting the waiver”).

⁹⁴ *NetworkIP, LLC v. FCC*, 548 F.3d 116, 127 (D.C. Cir. 2008).

⁹⁵ *Northeast Cellular Tel. Co.*, 897 F.2d at 1166. *See also, e.g., Omnipoint Corp. v. FCC*, 78 F.3d 620, 631 (D.C. Cir. 1996).

ATC operations, and meanwhile, L-band satellite incumbents have invested heavily in even more widely used consumer services. Thus, even if the waiver was appropriate in 2011, that would not suffice to establish that a waiver is appropriate today, because the current conditions show even more clearly that Ligado’s ATC operation would undermine the public interest.

Second, there are no special circumstances to justify a waiver. The Commission asserts that “several of the facts and circumstances” that led to the 2011 waiver remain in place today, including that Ligado is a significant and substantial provider of MSS, has invested over \$1 billion in the MSS systems, and is taking various actions to prepare for a terrestrial deployment.⁹⁶ To the extent the Commission believes these constitute special circumstances, it is incorrect. As an initial matter, the fact that Ligado is (allegedly) a substantial MSS provider *cannot* be a special circumstance justifying a waiver, since substantiality is a *separate* requirement for the provision of ATC services.⁹⁷ Treating substantiality as a basis for waiver would simply negate the integration requirement, not justify its waiver. At any rate, Ligado’s presence in the MSS market is marginal at best – and has been so for the ten years it has been focused on this terrestrial arbitrage effort.⁹⁸ In 2018, for example, Ligado represented only 1% of the MSS market.⁹⁹ Moreover, Ligado’s system consists of only three aging satellites, none of which can provide a robust service. MSAT-1 and MSAT-2 are each well over 20 years old; MSAT-2 “currently does not carry customer traffic,” and merely serves as a backup for SkyTerra-1.¹⁰⁰ Likewise, Ligado’s description of its third satellite, SkyTerra-1, as “one of the

⁹⁶ *Order* ¶ 121.

⁹⁷ *Id.* ¶ 120.

⁹⁸ *See, e.g.*, Letter from Bryan N. Tramont and Patrick R. Halley, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 12-340, 11-109 *et al.*, at 4 (filed July 26, 2018) (“Iridium July 26 Letter”).

⁹⁹ Telecom, Media & Finance Associates, *Satellite Mobility Perspectives* 69 (October 2018).

¹⁰⁰ *See* IBFS File No. SAT-MOD-20181214-00090, Exhibit D.

most sophisticated satellites flying today,”¹⁰¹ is preposterous, since SkyTerra-1 is itself nearly 10 years old and has been succeeded by hundreds of satellites launched since then. And, of course, neither Ligado nor its predecessors ever launched the fourth satellite, SkyTerra-2.¹⁰² In fact, given this record, it is apparent Ligado’s MSS system does not even meet the separate threshold “substantiality” requirement¹⁰³ – an independent deficiency the Commission failed to address.

Ligado’s investment in its satellite services is also not a special circumstance. The *Order* does not explain whether Ligado’s level of investment is meaningfully distinct from the norm. And Ligado’s preparation to deploy its spectrum in a terrestrial network is likewise a circumstance that would be present in any ATC application. To the extent its work with Ericsson and 3GPP to standardize its spectrum for various advanced services would be unique among similarly situated applicants, the *Order* does not explain any “appropriate general standard” against which other kinds of preparation could be judged.¹⁰⁴ The Commission therefore failed to “articulate the nature of the special circumstances.”¹⁰⁵

The *Order*’s remaining apparent justification falls short. The Commission claims that the waiver would “better serve,” or at least “not undermine,” the purpose of the gating criteria,¹⁰⁶ but

¹⁰¹ Reply Comments of Ligado, CB Docket No. BO 18-31, IB Docket No. 16-131, at 2 (Jan. 23, 2019).

¹⁰² These issues were raised repeatedly in the record. *See, e.g.*, Iridium July 26 Letter; Opposition of Coalition, IB Docket Nos. 11-109, 12-340 *et al.* (filed Jul. 25, 2019). Ligado noted in its application to the FCC to communicate with the Canadian-licensed SkyTerra-2 that it intended to launch the satellite in 2011. This launch never happened. LightSquared Subsidiary LLC, Application for Authority to Provide Mobile Satellite Service, including an Ancillary Terrestrial Component, in the United States Using SkyTerra 2, a Canadian-Authorized Satellite to be Located at the 107.3° W.L. Orbital Location, IBFS File No. SES-MFS-20101015-01297 (Oct. 15, 2010). This application was later withdrawn.

¹⁰³ 47 C.F.R. § 25.149(b)(1)-(3); *see In the Matter of LightSquared Subsidiary LLC*, 26 FCC Rcd. 566, 574-575 ¶ 16 (2011) (“2011 Order”).

¹⁰⁴ *Northeast Cellular*, 897 F.2d at 1166.

¹⁰⁵ *Id.*

¹⁰⁶ *Order* ¶¶ 120-121

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that is not part of the good-cause standard for waiver, and in any event, the Commission is wrong. Again, the waiver would allow Ligado to expand its terrestrial operation with minimal satellite offering, which contravenes the purpose of the gating criteria (which is to ensure the terrestrial component remain ancillary to the principal MSS offering).¹⁰⁷ The waiver conditions imposed here are quite similar to those the International Bureau placed on its 2011 waiver. Those conditions have failed to promote investment or provision of satellite service by Ligado. There is no reason to believe the new conditions will succeed where their predecessors failed.

CONCLUSION

For the reasons stated herein, the Commission should reconsider the *Order*, deny Ligado’s requested license modifications, and decline to waive the integrated service requirement.

Respectfully submitted,

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¹⁰⁷ See 2011 Order at ¶ 15. Indeed, this is precisely the opposite of what the Commission intended when it first adopted its ATC rules. See 2003 ATC Order, 18 FCC Rcd at 1965 ¶ 1.

**Update to 2016 Technical Assessment of Ligado User Terminal
Interference to Iridium**

1 DESCRIPTION OF INTERFERENCE PROBLEM

The FCC’s Order authorizing Ligado terrestrial services in the L-band spectrum goes to great length to address protection of incumbent services from Ligado base station interference but is woefully inadequate in protecting incumbent services from Ligado user equipment (“UE”) interference.¹ Ligado UE out-of-band emissions (“OOBE”), as adopted in the Order, reflect a slight decrease in emissions from what Ligado proposed in its 2015 modified application, but this reduction does not address Iridium’s interference concerns. In response to Ligado’s original proposed OOBE limits, Iridium provided a detailed analysis of the impact of Ligado interference to Iridium services in the adjacent band.² That analysis described multiple interference scenarios, using assumptions and methodologies accepted in similar Ligado interference studies with respect to GPS. What follows is a presentation of an updated interference analysis based on some new assumptions, including the new OOBE mask outlined in the FCC’s Order. The original methodology and assumptions remain the same for this analysis, except for the inclusion of an additional assumption regarding number of Ligado users within a Ligado base station cell. Details of the methodology and underlying assumptions can be found in the original interference assessment³.

Even under the revised OOBE limits, Ligado’s proposed operation of user terminals in the 1627.5-1637.5 MHz band, which is immediately adjacent to Iridium’s operations in the 1617.775-1626.5 MHz band, will produce harmful interference to Iridium end users.⁴ In some cases, **[BEGIN CONFIDENTIAL]**

[END

CONFIDENTIAL]

2 Overview of Ligado Interference Impact on Iridium

The FCC’s Order has not materially changed the conclusion that deployment of Ligado’s network will produce harmful interference to Iridium services. As Iridium has long argued on the record, Ligado’s proposed operations will cause significant interference into Iridium user terminals for two main reasons:

¹ *Lightsquared Technical Working Group Report et al.*, Order and Authorization, FCC 20-48 (rel. Apr. 22, 2020) (“Order”).

² See Technical Analysis of Ligado Interference Impact on Iridium User Link, IB Docket Nos. 11-109, 12-340 (filed Sept. 1, 2016) (“2016 Analysis”), attached to letter from Bryan N. Tramont, Counsel to Iridium, to Marlene H. Dortch, Secretary, FCC, IB Docket Nos. 11-109, 12-340 (filed Sept. 1, 2016).

³ *Id.*

⁴ Ligado’s user terminal transmissions in the 1646.5-1656.5 MHz band do not cause significant concerns for Iridium and are not studied here.

- Ligado’s OOB E within Iridium’s frequency band would significantly inhibit Iridium communications; and
- Millions of ubiquitously deployed ATC and/or terrestrial-only LTE user terminals would greatly increase the probability of these terminals operating near an Iridium terminal.

Iridium user terminals are authorized by the FCC to transmit and receive in the 1617.775-1626.5 MHz band.⁵ Ligado’s authorization for terrestrial services allows user terminals to transmit in the 1627.5-1637.5 MHz band. Though the FCC’s Order has proposed to somewhat reduce Ligado UE OOB E limits in the Iridium band, these limits are still completely inappropriate for a massive deployment of terrestrial network user terminals operating in the same geographic area in which very sensitive mobile satellite terminals are receiving satellite signals in the immediately adjacent band. As will be shown in section 5, even with the reduced OOB E limits adopted in the recent Order, these limits in the upper portion of Iridium’s band, **[BEGIN CONFIDENTIAL]** **[END**

CONFIDENTIAL] This is the interference produced by a single Ligado user. Given these excessive interference levels, the aggregate impact of this interference from multiple Ligado user terminals in respect of an ever-increasing Iridium subscriber base should also be assessed.

In contrast to the considerable attention that has been given to the case of Ligado ATC base station overload interference into GPS, we emphasize again that this is an entirely different interference problem for Iridium. The interference that is analyzed herein is based on Ligado UE OOB E emissions that exist within the Iridium receiver band, i.e., interference that cannot be mitigated through better Iridium receiver filtering or receiver design.

3 Summary of Iridium’s Original Ligado Interference Study

After Ligado submitted its 2015 modified application, which contained proposals for Ligado UE in-band maximum EIRP limits and maximum OOB E limits, Iridium conducted a detailed technical assessment (“2016 Analysis”) of the impact of Ligado user terminal interference to Iridium user terminals. The interference assessment in the 2016 Analysis did not consider Iridium receiver overload – it only studied impact of Ligado UE OOB E within the Iridium receive band, based upon the OOB E levels proposed by Ligado in its application.

Instead of creating an entirely new set of modeling assumptions, the 2016 Analysis borrowed assumptions that had already been studied and agreed upon in other working groups that had assessed Ligado interference to GPS, as well as other terrestrial wireless service compatibility with satellite services in the same geographic region.⁶

⁵ Iridium’s Certus™ terminals are authorized to operate in the 1618.725-1626.5 MHz portion of Iridium’s band. *Iridium Carrier Services LLC*, File No. SES-MOD-20170413-00389 as amended by SES-AMD-20170726-00813 (granted Mar. 2, 2016); *Iridium Satellite LLC*, File No. SES-MOD-20170413-00388 as amended by SES-AMD-20170726-00812 (granted Mar. 6, 2018).

⁶ See Commerce Spectrum Management Advisory Committee, Final Report, Working Group 1 – 1695-1710 MHz Meteorological-Satellite, Rev. 1, App. 3 at 4 (July 23, 2013) (“CSMAC Assessment”), https://www.ntia.doc.gov/files/ntia/publications/wg1_report_07232013.pdf. See also RTCA Special Committee 159, Assessment of the LightSquared Ancillary Terrestrial

Details of the assumptions and methodology can be found in the 2016 Analysis and are not replicated in entirety here. A summary of the key assumptions used in the assessment were:

- Iridium user terminal interference protection criterion of an interference-to-noise (I/N) ratio of -6 dB. Again, this is with respect to Ligado emissions within Iridium's received band.
- Two values for number of Ligado users per cell were assumed: 18 and 300 (the latter was used in the RTCA SC-159 assessment).⁷
- Free space path loss propagation was assumed for cases in which the Ligado interfering terminal was within 100 meters of the Iridium terminal, and the land mobile Hata-Okumura propagation model was used for separation distances greater than 100 meters to account for propagation losses due to terrain (noting that the Hata-Okumura propagation model was used in the RTCA SC-159 Ligado study).⁸

Four broad interference scenarios were considered:

1. Baseline interference assessment used to determine the maximum range at which a single Ligado UE could cause interference to a victim Iridium receiver under free space path loss (FSPL) conditions.
2. Aggregate interference from a uniformly distributed number of Ligado users to a single Iridium user in a low density Ligado user deployment (i.e., 18 Ligado users in larger, rural cells having inter-site distances of 7 km).⁹
3. Aggregate interference in a medium density Ligado user deployment (i.e., 18 Ligado users in small suburban cells having inter-site distances of 2 km).¹⁰
4. Aggregate interference in a high density Ligado user deployment (i.e., 300 Ligado users in a small, 1 km radius suburban cells).

The results of the baseline assessment found that, in the worst case situation, emissions from a single Ligado UE could exceed Iridium's protection criterion at a distance of up to **[BEGIN CONFIDENTIAL]** **[END CONFIDENTIAL]**.¹¹ For the aggregate interference scenarios, very large, positive I/N values were found in each scenario and as one would expect the interference impact worsened with increasing Ligado user density.

Component Radio Frequency Interference Impact on GNSS L1 Band Airborne Receiver Operations, (June 3, 2011) ("SC-159 Assessment"), http://licensing.fcc.gov/myibfs/download.do?attachment_key=900115.

⁷ SC-159 Assessment, at 17.

⁸ The model used in this report is identical to the model used in the SC-159 Assessment. *Id.* at 46 & App. B at B-6.

⁹ See CSMAC Assessment.

¹⁰ In the CSMAC Assessment, a value of 1.7 km was used; in the SC-159 Assessment, a value of 2.2 km was used.

¹¹ 2016 Analysis at 2.

4 Revised Ligado Interference Study

4.1 BASIS OF REVISIONS

4.1.1 REVISED LIGADO UE OOBE LIMITS

The FCC’s recent Order made a slight revision to Ligado UE OOBE limits within the adjacent Iridium band.¹² Specifically, the new OOBE limits are defined as:

- -67 dBW/4kHz (or -58.2 dBW/30kHz) at 1627.5 MHz
- A level determined by linearly interpolating between the above value at 1627.5 MHz and -100 dBW/MHz at 1610 MHz.

At the top of Iridium’s band, these revised limits are approximately 12 dB lower than what Ligado originally proposed in its 2015 application. A comparison of the originally proposed OOBE mask with the mask in the FCC’s Order are shown in Figure 1 (emission limits have been converted to units of dBW/30kHz). Although a 12 dB reduction in the OOBE is helpful for protecting Iridium, **[BEGIN CONFIDENTIAL]**

[END CONFIDENTIAL]

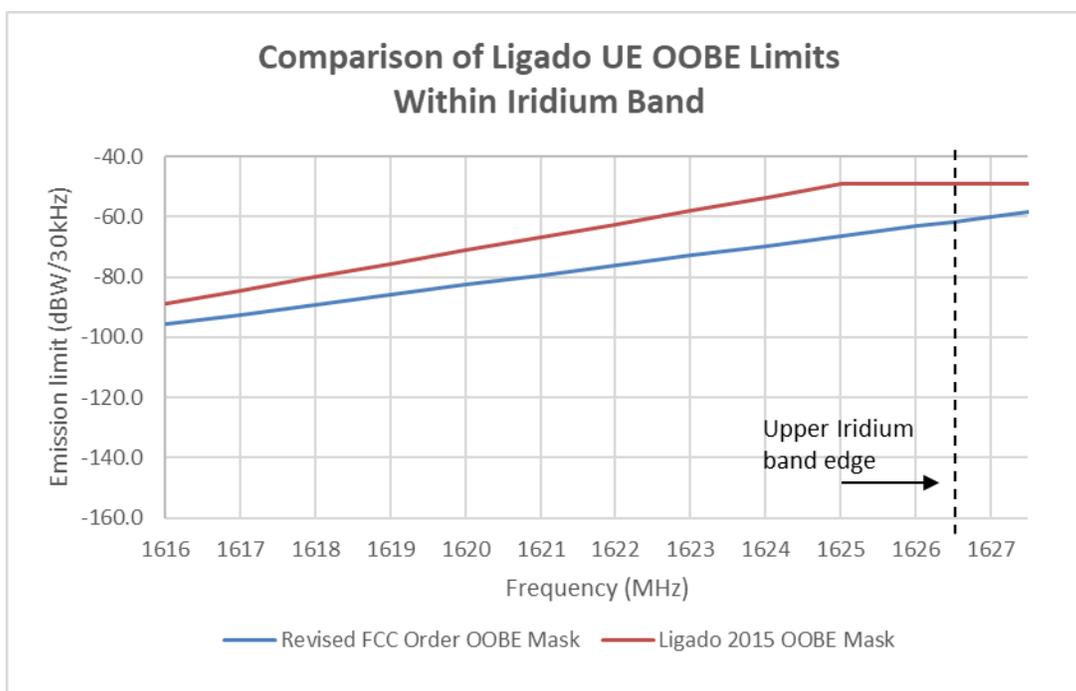


Figure 1: Comparison of Ligado OOBE limits

¹² Order, at ¶139.

4.1.2 REVISED NUMBER OF LIGADO USERS PER CELL

The Order noted that Iridium’s original interference analysis was “conservative” because it assumed that there would be 18 Ligado user terminals transmitting simultaneously per cell¹³, though no justification for this judgment was provided. Given that significantly larger numbers of LTE users per cell have been considered in other studies and given the massive, exponential growth in wireless subscriber traffic in recent years, 18 simultaneous users per cell does not seem to be a “conservative” value. Nevertheless, in order to address this concern in the Order, we have added a new interference analysis assumption in which only 6 Ligado users per cell (i.e., 2 users per sector) are transmitting at a time. Nevertheless, because the interference generated by a single Ligado user has the potential to greatly exceed Iridium’s protection criterion, the results described below will show that this reduction in total simultaneous Ligado users per cell has little impact on the aggregate interference.

In addition, this revised interference assessment only examines low density and medium density Ligado user deployment scenarios.

4.2 REVISED INTERFERENCE RESULTS: BASELINE SINGLE LIGADO USER WITH UNOBSTRUCTED PATH

The 2016 Analysis considered the baseline interference scenario of a single Ligado user at various ranges from the Iridium receiver, assuming unobstructed, free space path loss (FSPL) conditions. This baseline analysis provided an upper bound on what kind of separation distances would be needed when there is a clear path between the Ligado user and victim Iridium user. The 2016 Analysis showed that interference from a single Ligado user was possible at a range of [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] Applying the new Ligado UE OOB mask described in the recent Order, we find the results shown Table 1. Even with the reduced OOB mask, interference is still possible at a separation distance of [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] Given the continued increase in Iridium subscribers (now over 1.33 million subscribers at end of 2020 Q1, an increase of 65% over the 800,000 subscribers in place when the 2016 Analysis was originally created),¹⁴ and given the expected massive deployment of Ligado LTE users in this band, opportunities for Ligado and Iridium users to be in close proximity will exist. The table shows I/N values for separation distances of 10, 100 and 1000 meters that significantly exceed Iridium’s protection criterion.

¹³ Order at ¶ 117.

¹⁴ Iridium Communications Inc., Annual Report (Form 10-K), at 3 (Feb. 25, 2020), <https://www.sec.gov/ix?doc=/Archives/edgar/data/1418819/000141881920000004/irdm1231201910k.htm> (“Iridium 10-K”).

[BEGIN CONFIDENTIAL]¹⁵

Table 1: Baseline interference: single Ligado user interference over unobstructed path

Frequency	1626.5	1626.5	1626.5	MHz
Single Ligado user terminal OOB limit	-61.5	-61.5	-61.5	dBW/30kHz
Separation distance	10.0	100.0	1000.0	m
Path loss	56.6	76.6	96.6	dB
Iridium receiver antenna gain at horizon	-3.0	-3.0	-3.0	dBi
Received interference power density				dBW/30kHz
Iridium user terminal noise floor	-154.8	-154.8	-154.8	dBW/30kHz
I/N				dB
Required I/N	-6	-6	-6	dB
Margin				dB

[END CONFIDENTIAL]

4.3 REVISED INTERFERENCE RESULTS: LOW DENSITY LIGADO USER DEPLOYMENT

In this scenario, the same methodology used in the 2016 Analysis for low density Ligado user deployment is applied here, with the new Ligado OOB limits and a reduced number of simultaneous Ligado users.

In this case, “low density deployment” refers to 18 (or 6) Ligado users uniformly distributed in cells that have inter-base-station distances of 7 km (i.e., cell radii of 3.5 km), such as would be found in a rural setting. As in the 2016 Analysis, a single Iridium user is considered within this low density deployment region and the aggregate interference from all Ligado users within 1, 5 or 10 km of the Iridium receiver are summed together, taking into account the Hata-Okumura land mobile radio propagation model.¹⁶ The aggregate interference does not materially change when considering interference ranges of 1, 5 or 10 km, since the aggregate interference is dominated by those Ligado UE that are within several hundred meters of the Iridium receiver. The results are shown in Tables 2 and 3, for the case of 18 Ligado users per cell and 6 users per cell, respectively. Even for this extremely conservative case in which only 6 Ligado users are transmitting in a large cell, Iridium’s protection criterion is exceeded [BEGIN CONFIDENTIAL]

[END CONFIDENTIAL]

¹⁵ Only confidential information redacted.

¹⁶ In the tables, “weighted average path loss” refers to taking the path loss to each Ligado interferer and determining an average path loss weighted by the probability of each user being at a certain distance from the Iridium user. This weighted path loss is then applied to every Ligado user within the 1, 5 or 10 km interference range. See original 2016 Analysis at 12-17.

[BEGIN CONFIDENTIAL]¹⁷

Table 2: Ligado UE interference: low density deployment, 18 users per cell

Frequency	1626.5	1626.5	1626.5	MHz
Ligado user terminal OOB limit	-61.5	-61.5	-61.5	dBW/30kHz
Interference radius from Iridium user	1.0	5.0	10.0	km
Ligado users per cell	18.0	18.0	18.0	
Ligado cell radius	3.5	3.5	3.5	km
Number of Ligado users within interference radius	1.5	36.7	146.9	
Weighted average path loss	90.5	104.5	110.5	dB
Iridium receiver antenna gain at horizon	-3.0	-3.0	-3.0	dBi
Aggregate received interference power density				dBW/30kHz
Iridium user terminal noise floor	-154.8	-154.8	-154.8	dBW/30kHz
I/N				dB
Required I/N	-6	-6	-6	dB
Margin				dB

Table 2: Ligado UE interference: low density deployment, 6 users per cell

Frequency	1626.5	1626.5	1626.5	MHz
Ligado user terminal OOB limit	-61.5	-61.5	-61.5	dBW/30kHz
Interference radius from Iridium user	1.0	5.0	10.0	km
Ligado users per cell	6.0	6.0	6.0	
Ligado cell radius	3.5	3.5	3.5	km
Number of Ligado users within interference radius	0.5	12.2	49.0	
Weighted average path loss	90.5	104.5	110.5	dB
Iridium receiver antenna gain at horizon	-3.0	-3.0	-3.0	dBi
Aggregate received interference power density				dBW/30kHz
Iridium user terminal noise floor	-154.8	-154.8	-154.8	dBW/30kHz
I/N				dB
Required I/N	-6	-6	-6	dB
Margin				dB

[END CONFIDENTIAL]

4.4 REVISED INTERFERENCE RESULTS: MEDIUM DENSITY LIGADO USER DEPLOYMENT

For this scenario, again the same methodology used in the 2016 Analysis for medium density Ligado user deployment is applied here, but with the revised Ligado OOB limits and a reduced number of simultaneous Ligado users.

In this case, “medium density deployment” refers to 18 (or 6) Ligado users uniformly distributed in cells that have inter-base-station distances of 2 km (i.e., cell radii of 1 km), such as would be

¹⁷ Only confidential information redacted.

found in an urban or suburban setting. The aggregate interference from Ligado users, assuming this density, is determined with respect to a single Iridium user. As above, the aggregate interference does not materially change when considering interference ranges of 1, 5 or 10 km, since Ligado UE that are within several hundred meters of the Iridium receiver dominate. The results are shown in Tables 4 and 5, for the case of 18 Ligado users per cell and 6 users per cell, respectively. For this more realistic deployment case, Iridium’s protection criterion is significantly exceeded and would certainly be considered harmful.

[BEGIN CONFIDENTIAL]¹⁸

Table 4: Ligado UE interference: medium density deployment, 18 users per cell

Frequency	1626.5	1626.5	1626.5	MHz
Ligado user terminal OBE limit	-61.5	-61.5	-61.5	dBW/30kHz
Interference radius from Iridium user	1.0	5.0	10.0	km
Ligado users per cell	18.0	18.0	18.0	
Ligado cell radius	1.0	1.0	1.0	km
Number of Ligado users within interference radius	18.0	450.0	1800.0	
Weighted average path loss	90.5	104.5	110.5	dB
Iridium receiver antenna gain at horizon	-3.0	-3.0	-3.0	dBi
Aggregate received interference power density				dBW/30kHz
Iridium user terminal noise floor	-154.8	-154.8	-154.8	dBW/30kHz
I/N				dB
Required I/N	-6	-6	-6	dB
Margin				dB

Table 5: Ligado UE interference: medium density deployment, 6 users per cell

Frequency	1626.5	1626.5	1626.5	MHz
Ligado user terminal OBE limit	-61.5	-61.5	-61.5	dBW/30kHz
Interference radius from Iridium user	1.0	5.0	10.0	km
Ligado users per cell	6.0	6.0	6.0	
Ligado cell radius	1.0	1.0	1.0	km
Number of Ligado users within interference radius	6.0	150.0	600.0	
Weighted average path loss	90.5	104.5	110.5	dB
Iridium receiver antenna gain at horizon	-3.0	-3.0	-3.0	dBi
Aggregate received interference power density				dBW/30kHz
Iridium user terminal noise floor	-154.8	-154.8	-154.8	dBW/30kHz
I/N				dB
Required I/N	-6	-6	-6	dB
Margin				dB

[END CONFIDENTIAL]

¹⁸ Only confidential information redacted.

5 Summary of Results

This report provides an updated analysis of single terminal and aggregate Ligado UE interference to Iridium user terminals. The analysis serves as an update to the original 2016 Analysis by taking into account changes based on the recent FCC Order authorizing Ligado terrestrial operations.

Despite the slight reduction in Ligado's OOB limits as adopted in the Order, Ligado UE emissions still pose a serious threat to Iridium services in the adjacent band. A single Ligado user produces a high enough interference level that it can impact an Iridium user [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] away. When considering real-world deployment of a Ligado terrestrial network, the aggregate interference from Ligado users can produce interference levels that exceed Iridium's protection criterion by [BEGIN CONFIDENTIAL] [END CONFIDENTIAL] in even modest Ligado deployment densities. Given the extremely high Ligado OOB levels within the Iridium satellite receiver band and given the potential for a mass deployment of millions of Ligado users throughout the country, it comes as no surprise that the potential for significant interference remains.